

ABSTRACT

It has been reported in the literature that raceway measurement made during the decreasing gas velocity is relevant to operating blast furnaces. However, no raceway correlation is available either for decreasing or increasing gas velocity which is developed based on a systematic study and none of the available correlation take care of frictional properties of the material. Therefore, a systematic experimental study has been carried out on raceway hysteresis. Based on experimental data and using dimensional analysis, two raceway correlations, one each for increasing and decreasing gas velocity, have been developed. Also, in the present study the effect of stresses has been considered along with pressure and bed weight terms mathematically. These three forces are expressed in mathematical form and solved analytically for one-dimensional case, using a force balance approach. Based on the force balance approach a general equation has been obtained to predict the size of the cavity in each case, i.e., for increasing and decreasing velocity. Results of these correlations and model have been compared with the data obtained from literature on cold and hot models and plant data along with some experimental data. An excellent agreement has been found between the predicted (using correlations and model) and experimental values. The proposed theory is applicable to any packed bed systems. It has been shown that hysteresis mechanism in the packed beds can be described reasonably taking into consideration the reversal of sign in frictional forces in increasing and decreasing velocity cases.